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E St.Lawrence Deep Waterway
International Rapids Section.
Reports submitted to the
President of the United States
of America and the Prime
Minister of Canada, by the
Canadian Temporary Great Lakes-
St.Lawrence Basin Committee
and the United States St.Law-
rence Advisory Committee.



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ST. LAWRENCE DEEP WATERWAY INTERNATIONAL RAPIDS SECTION

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Publications

REPORTS SUBMITTED TO THE PRESIDENT OF
THE UNITED STATES OF AMERICA AND THE
PRIME MINISTER OF CANADA, BY THE CANA-
DIAN TEMPORARY GREAT LAKES - ST. LAW-
RENCE BASIN COMMITTEE AND THE UNITED
STATES ST. LAWRENCE ADVISORY COMMITTEE.

1. JOINT REPORT SUBMITTED BY THE COMMITTEES.
2. ENGINEERING REPORT TRANSMITTED BY THE COMMITTEES.
3. DETAILED ESTIMATE OF COST.


OTTAWA, CANADA, JANUARY 3, 1941



OTTAWA
EDMOND CLOUTIER
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1941

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THE UNITED STATES OF AMERICA AND THE
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1. JOINT REPORT

To: THE PRESIDENT OF THE UNITED STATES
THE PRIME MINISTER OF CANADA

The Canadian Temporary Great Lakes-St. Lawrence Committee and the United States St. Lawrence Advisory Committee, meeting at Ottawa, January 2 and 3, 1941, respectfully submit the following joint report on the preliminary engineering and other investigations for that part of the Great Lakes-St. Lawrence Basin project located in the International Rapids Section of the St. Lawrence River.

The two Committees held their first joint meeting at Massena, N.Y., on October 31, 1940, to determine upon the project plan best designed to serve the interests of both countries and to agree upon the general lines which the engineering investigation should follow. The Committees met again at Massena on November 15, 1940, to consult with a group of outstanding hydraulic and electric experts on technical aspects of the proposed undertaking.

Special consideration has been given to the joint report prepared in January, 1940, by a board of engineers representing Canada and the United States, including for Canada: Guy A. Lindsay, Engineer in Charge, General Engineering Branch, Department of Transport; Olivier O. Lefebvre, Vice-Chairman of the Quebec Streams Commission; T. H. Hogg, Chairman and Chief Engineer of the Hydro-Electric Power Commission of Ontario and M. C. Hendry, Assistant Engineer, Hydro-Electric Power Commission of Ontario; for the United States: Brigadier General Thomas M. Robins, Corps of Engineers, U.S. Army; Roger B. McWhorter, Chief Engineer, Federal Power Commission; and Gerald V. Cruise, Executive Secretary and Acting Chief Engineer of the Power Authority of the State of New York.

These engineers were requested by the two Governments to examine the various plans proposed for the development of the International Rapids Section of the St. Lawrence River, together with their estimates of cost, and to recommend the plan best adapted to the needs of both countries. They agreed unanimously that the "238 - 242" Controlled Single Stage Project was the best from an engineering and economic point of view, bearing in mind the requirements of navigation and power and the protection of down-river interests.

The two Committees, at the meeting of October 31, 1940, agreed that the engineering investigations should be undertaken in accord with the project as described in the engineering report above referred to. Subsequent investigations, including the testing of foundation conditions, etc., which have been proceeding rapidly, have sustained the conclusion that the "238 - 242" Controlled Single

Stage Project is the plan best adapted for the development of that part of the Great Lakes-St. Lawrence Basin project located in the International Rapids Section of the St. Lawrence River for the following reasons:—

- (1) The plan combines the essential features which have been continuously advocated by the representatives of both countries throughout the long period of study and negotiation devoted to the undertaking. Specifically, it provides for the development of all the power in one stage at power houses located at the foot of Barnhart Island, while at the same time providing for complete control of the River at a control dam located near the head of the present rapids.
- (2) The plan is especially designed to assure full protection to the downstream power and navigation interests in the Province of Quebec, including the harbour of Montreal, while at the same time providing for the economical development of the International Rapids Section for navigation and power as a part of the general Great Lakes-St. Lawrence Basin project.
- (3) The recent investigations, including the checking of previous explorations, new core borings, etc., indicate that the foundation conditions for the proposed dams, navigation locks and power houses are satisfactory, while consultations with outstanding hydro-electric engineers assure that the project works will be sound and the construction and equipment of the power houses in accord with the best modern practice.
- (4) The construction program can be arranged so that delivery of power can be begun and navigation provided within four years of the time when active work is initiated, time being an essential factor in the emergency.

Throughout their investigations, the two Committees have been constantly impressed with the defense aspects of the project as a part of a long range program for use of the Great Lakes-St. Lawrence basin by both peoples to strengthen the defenses of the North American Continent. The power which the project will provide is urgently needed for expansion of essential defense production on both sides of the border. A deep waterway will afford an unexampled opportunity for the expansion of shipbuilding, both cargo vessels and naval vessels, in naturally protected waters.

At the request of the two Committees, the engineers who prepared the report of January, 1940, have carefully reconsidered that report in the light of the engineering investigations and have revised the cost estimates to take account of the effect of recent increases in construction costs and the acceleration of the construction program in the interest of defense. Their final conclusions, embodied in a report dated January 3, 1941, confirm the conclusions of the previous report.

The two Committees submit herewith the report of the board of engineers as embodying their own conclusions and recommend that, in the event that the Governments decide to proceed with the development of the International Rapids Section of the St. Lawrence River, the work be undertaken in general accordance with the plan of the "238 - 242" Controlled Single Stage Project described therein.

Respectfully submitted,

Canadian Committee

GUY A. LINDSAY

T. H. HOGG

OLIVIER O. LEFEBVRE

J. E. READ

United States Committee

LELAND OLDS

A. A. BERLE, Jr.

THOMAS M. ROBINS

GERALD V. CRUISE

OTTAWA, CANADA, January 3, 1941.

2. ENGINEERING REPORT

ST. LAWRENCE DEEP WATERWAY INTERNATIONAL RAPIDS SECTION

OTTAWA, CANADA,

January 3, 1941.

In view of the re-opening of negotiations between representatives of the United States and Canada in respect of the improvement both for navigation and power of the International Rapids Section of the St. Lawrence River, engineers representing both countries were asked to examine the various plans proposed with their estimates of cost.

The engineers representing the United States were:—

- Brig. Gen. Thomas M. Robins, Corps of Engineers, U.S. Army.
- Mr. Roger B. McWhorter, Chief Engineer, Federal Power Commission.
- Mr. Gerald V. Cruise, Executive Secretary and Acting Chief Engineer, New York State Power Authority.

The engineers representing Canada were:—

- Mr. Guy A. Lindsay, Engineer-in-Charge, General Engineering Branch, Department of Transport.
- Dr. Olivier O. Lefebvre, Vice-Chairman, Quebec Streams Commission.
- Dr. T. H. Hogg, Chairman and Chief Engineer of the Hydro-Electric Power Commission of Ontario.
- Mr. M. C. Hendry, Assistant Engineer, Hydro Electric Power Commission of Ontario.

After careful consideration of the projects proposed and the estimates of cost thereof, the engineers agreed that the "238 - 242" Controlled Single Stage Project is, in their opinion, the best from an engineering and economic point of view, bearing in mind the requirements of navigation and power and the protection of down river interests.

The main features of the "238 - 242" Controlled Single Stage Project are as follows:—

- (1) A control dam in the vicinity of Iroquois Point.
- (2) A dam in the Long Sault Rapids at the head of Barnhart Island and two power houses, one on either side of the International Boundary, at the foot of Barnhart Island.
- (3) A side canal, with one lock on the United States mainland to carry navigation around the control dam and a side canal, with one guard gate and two locks, on the United States mainland south of Barnhart Island to carry navigation from above the main Long Sault Dam to

the river south of Cornwall Island. All locks to provide 30-foot depth of water on the mitre sills and to be of the general dimensions of those on the Welland Ship Canal. All navigation channels to be excavated to 27-ft. depth.

- (4) Dykes, where necessary, on the United States and Canadian sides of the International Boundary, to retain the pool level above the Long Sault Dam.
- (5) Channel enlargement from the head of Galop Island to below Lotus Island designed to give a maximum velocity in the navigation channel south of Galop Island not exceeding four feet per second at any time.
- (6) Channel enlargement between Lotus Island and the control dam and from above Point Three Points to below Ogden Island designed to give a maximum mean velocity in any cross-section not exceeding two and one-quarter feet per second with the flow, and at the stage, to be permitted on the 1st of January of any year, under regulation of outflow and levels of Lake Ontario.
- (7) The necessary railroad and highway modifications on either side of the International Boundary.
- (8) The necessary works to permit the continuance of 14-ft. navigation on the Canadian Side around the control dam and from the pool above the Long Sault Dam to connect with the existing Cornwall Canal.
- (9) The rehabilitation of the towns of Iroquois and Morrisburg, Ontario.

All the works in the pool below the control dam shall be designed to provide for full Lake Ontario level but initially the pool shall be operated at maximum elevation 238.0.

Attached hereto is the detailed estimate of cost of this project revised to take into account rising construction costs and additional expense likely to be incurred in expediting the work in the interest of National Defence. The total estimated cost is believed to be sufficient to complete the work.

THOMAS M. ROBINS,
*Brigadier General,
Corps of Engineers,
U.S. Army.*

GUY A. LINDSAY,
*Engineer-in-Charge,
General Engineering Branch,
Department of Transport,
Ottawa, Ont.*

3. DETAILED ESTIMATE OF COST

ST. LAWRENCE DEEP WATERWAY INTERNATIONAL RAPIDS SECTION DETAILED ESTIMATE OF COST

OF

CONTROLLED SINGLE STAGE PROJECT "238 - 242"

**To Accompany the Report of the Canadian and United States Engineers,
dated Ottawa, Canada, January 3, 1941**

DETAILED ESTIMATES OF CONTROLLED SINGLE STAGE PROJECT "238 - 242"

The detailed estimates are set up under three main divisions:—

- (A) Works Solely for Navigation.
- (B) Works Primarily for Power.
- (C) Works Common to Navigation and Power.

(A) Works Solely for Navigation—Under this heading are included the locks, entrance piers, channel or canal excavation and all other works required solely for the purposes of navigation.

(B) Works Primarily for Power—The items included under this heading are subdivided into:

- (i) Structures, Head and Tailrace Excavation—Under this heading are included all earth and rock excavation, ice sluices, railway connections, etc., required primarily for power, as well as the substructures and superstructures of the power houses. The substructures include headworks, gates, racks, unwatering gates, gate checks, all gate-operating equipment, intakes, water passages, draft tubes, tailrace piers and deck, all covers for openings, railings, gratings, ladders, drains, piping, conduit, pit liners, speed rings, throat rings, draft-tube liners, scroll cases (whether moulded in concrete or of cast or plate steel), and all parts embedded in the substructures incidental thereto or connected therewith. The substructures, as estimated, are of sufficient dimensions to accommodate all equipment and apparatus including transformers and provide the necessary space for assembly, operation and maintenance.
- (ii) Machinery and Equipment—Under this heading are included turbines, governors, generators, and all other auxiliary machinery required above the generator floor, as well as the low voltage switching, control and operating apparatus.

(C) Works Common to Navigation and Power—Under this heading are included all channel excavation required for river enlargement, all dams, and dykes required to retain the levels in the pools created for navigation and power purposes, all land and property damages resulting from the raised water levels, all works in connection with the rehabilitation of Morrisburg and Iroquois, the preservation of 14-ft. navigation on the Canadian side, railway and highway modifications and all other works not included under "A" and "B".

**ST. LAWRENCE DEEP WATERWAY
INTERNATIONAL RAPIDS SECTION
CONTROLLED SINGLE STAGE PROJECT
"238 - 242"**

SUMMARY OF ESTIMATE

(A) Works solely for Navigation.		
(i) Upper Pool—at Point Rockway.....	\$ 7,497,000	
(ii) Lower Pool—Opposite Barnhart Isd.....	31,081,000	
	<hr/>	\$ 38,578,000
(B) Works primarily for Power.		
(i) Structures, Head and Tailrace Exc'n.....	46,476,000	
(ii) Machinery and Equipment.....	50,328,000	
	<hr/>	96,804,000
(C) Works common to Navigation and Power.		
1. Channel excavation.....	48,136,000	
2. Ice cribs above Prescott and above Galop Isd.....	656,000	
3. Iroquois Point Dam.....	7,310,000	
4. Dykes	12,374,000	
5. Supply channel and weir at Massena.....	2,363,000	
6. Diversion cut through Long Sault Isd.....	2,569,000	
7. Main Long Sault Dam.....	20,055,000	
8. Guard Gate, 14-ft. Lock and Weir at Maple Grove.....	2,624,000	
9. 14-ft. Lock and Dykes at Iroquois.....	604,000	
10. Railroad relocation.....	3,696,000	
11. Clearing pool.....	518,000	
12. Rehabilitation of Morrisburg.....	5,024,000	
13. Rehabilitation of Iroquois.....	3,379,000	
14. Acquisition of lands, etc., U.S. side.....	4,657,000	
15. Acquisition of lands, etc., Can. side.....	14,011,000	
16. Highway relocation.....	2,812,000	
	<hr/>	130,788,000
Grand total.....		<hr/> \$266,170,000

**ST. LAWRENCE DEEP WATERWAY
INTERNATIONAL RAPIDS SECTION**

CONTROLLED SINGLE STAGE PROJECT

“ 238 — 242 ”

(A) WORKS SOLELY FOR NAVIGATION—(27 FT. DEPTH)

(i) Upper Pool at Point Rockway

No.	Item	Unit	Quantity	Rate	Amount	Total
1	Guide Pier in South Galop— Cribwork.....	c.y.	6,000	5.00	30,000	\$30,000
2	Point Three Points Lock and Entrance Piers— Concrete.....	c.y.	141,960	10.00	1,419,600	
	Cribwork.....	c.y.	94,730	5.00	473,650	3,129,950
	Excavation—earth.....	c.y.	220,000	0.40	88,000	
	earth.....	c.y.	40,000	0.65	26,000	
	Lock gates, valves, operating machinery, etc.....				947,700	
	Emergency gate.....				175,000	
3	Approach channels to Point Three Points Lock— Excavation—earth.....	c.y.	3,030,000	0.40	1,212,000	1,569,350
	earth.....	c.y.	106,000	0.65	68,900	
	dredging.....	c.y.	320,500	0.90	288,450	
4	Dykes— Earth fill.....	c.y.	1,002,770	0.90	902,490	1,067,990
	Rock fill.....	c.y.	63,740	1.00	63,740	
	Stripping.....	c.y.	156,560	0.65	101,760	
5	Land Damage.....				200,000	200,000
6	Engineering and Contingencies.....			25%		1,499,710
7	Total.....					7,497,000

(ii) Lower Pool—Opposite Barnhart Island

1	Channel Excavation— (a) Above Long Sault Isd. to Robinson Bay Lock— Excavation—dry earth.....	c.y.	2,513,880	0.65	1,634,020	1,744,240
	Paving.....	c.y.	10,020	11.00	110,220	
	(b) Robinson Bay Lock to Grass River Lock— Excavation—dry earth.....	c.y.	2,942,200	0.65	1,912,430	1,912,430
	(c) Grass River Lock to Shore Line— Excavation—dredging.....	c.y.	374,000	0.80	299,200	299,200
	(d) At lower end of Cornwall Isd.— Excavation—dredging.....	c.y.	522,000	0.80	417,600	497,600
	overdepth.....	c.y.	100,000	0.80	80,000	
	(e) At mouth of Grass River— Excavation—dredging.....	c.y.	227,000	0.80	181,600	181,600
2	Drainage ditch Excavation—earth.....	c.y.	10,200	0.65	6,630	6,630
	Carried forward.....					4,641,700

(ii) Lower Pool—Opposite Barnhart Island—Continued

No.	Item	Unit	Quantity	Rate	Amount	Total
	Brought forward.....					\$4,641,700
3	Dykes—					
	(a) Above Robinson Bay Lock—					
	Earth fill.....	c.y.	807,860	0.42	339,300	
	Earth fill.....	c.y.	2,262,560	0.90	2,036,310	
	Rock fill.....	c.y.	49,500	1.00	49,500	
	Stripping.....	c.y.	312,110	0.65	202,880	
	Trimming.....	s.y.	191,370	0.25	47,840	
	Sodding.....	s.y.	17,000	0.45	7,650	
						2,683,480
	(b) Robinson Bay Lock to Grass River—					
	Earth fill.....	c.y.	669,270	0.42	281,090	
	Earth fill.....	c.y.	357,250	0.60	214,350	
	Stripping.....	c.y.	146,510	0.65	95,230	
	Trimming.....	s.y.	167,010	0.25	41,750	
	Sodding.....	s.y.	22,000	0.45	9,900	
	Paving—concrete.....	c.y.	13,880	11.00	152,680	
						795,000
	(c) Rock fill guide dyke below Grass River Lock—					
	Rock fill.....	c.y.	63,000	2.00	126,000	
						126,000
4	Guard Gate and Supply Weir above Robinson Bay Lock—					
	Concrete.....	c.y.	4,520	12.00	54,240	
	Concrete.....	c.y.	38,080	10.00	380,800	
	Foundation contingency.....				5,400	
	Cribwork.....	c.y.	41,720	5.00	208,600	
	Excavation—earth.....	c.y.	39,240	0.65	25,510	
	trench.....	c.y.	3,310	3.10	10,260	
	Sheeting and bracing.....	M.F.B.M.	59	110.00	6,490	
	Lock gates, operating machinery, etc.....				149,000	
	Sluice gates, hoists, etc.....				33,800	
						874,120
5	Robinson Bay Lock—Entrance piers and weir—					
	Concrete.....	c.y.	305,920	10.00	3,059,200	
	Concrete.....	c.y.	114,600	15.00	1,719,000	
	Cribwork.....	c.y.	84,390	5.00	421,950	
	Excavation—earth.....	c.y.	878,530	0.65	571,040	
	Lock gates and operating machinery.....				801,000	
	Lock valves and operating machinery.....				100,000	
	Emergency gate.....				175,000	
	Fenders, capstans, lighting equipment, etc.....				206,700	
	Sluice gates, hoists, etc.....				52,690	
						7,106,580
6	Regulating weir at Robinson Bay—					
	Concrete.....	c.y.	13,200	12.00	158,400	
	Concrete.....	c.y.	22,190	10.00	221,900	
	Foundation contingency.....				15,840	
	Excavation—Rock footings.....	c.y.	2,970	2.40	7,130	
	Rock trench.....	c.y.	450	4.10	1,850	
	Earth.....	c.y.	348,360	0.65	226,430	
	Unwatering.....				35,650	
	Sluice gates, hoists, etc.....				30,800	
						698,000
7	Grass River Lock and Entrance Piers—					
	Concrete.....	c.y.	351,060	10.00	3,510,600	
	Excavation—earth.....	c.y.	1,296,950	0.65	843,020	
	Cribwork.....	c.y.	76,050	5.00	380,250	
	Lock gates and operating machinery.....				845,600	
	Lock valves and operating machinery.....				100,000	
	Fenders, capstans, lighting equipment, etc.....				206,700	
						5,886,170
8	N.Y.C. Rly. Diversion and bridges.....				1,308,000	
						1,308,000
9	Canal lighting and office.....				16,000	
						16,000
10	Clearing pool—					
	Clearing.....	acre	150	100.00	15,000	
						15,000
	Carried forward.....					24,150,050

(ii) Lower Pool—Opposite Barnhart Island—Concluded

No.	Item	Unit	Quantity	Rate	Amount	Total
	Brought forward.....					\$24,150,050
11	Roads—					
	Diversions.....	Mile	1.25	30,000	37,500	
	Improvements.....	Mile	2.75	3,000	8,250	
	New.....	Mile	2.40	30,000	72,000	117,750
12	Property damages—Lower Pool—					
	Flowage.....				330,330	
	Severance.....				266,600	
13	Engineering and Contingencies.....			25%		596,930
						6,216,270
14	Total (27 ft. depth).....					31,081,000

(B) WORKS PRIMARILY FOR POWER**(i) Structures, Head and Tailrace Excavation**

1	Tailrace Excavation—					
	(a) Tailrace—					
	Excavation—dry earth.....	c.y.	3,868,300	0.65	2,514,400	
	dry rock.....	c.y.	327,320	1.60	523,710	
	dredging.....	c.y.	844,560	0.90	760,100	
					3,798,210	
	Credit for rock excavation.....				327,320	3,470,890
	(b) Crab Island Shoal—					
	Excavation—dredging.....	c.y.	1,284,930	0.90	1,156,440	
	“ overdepth....	c.y.	178,000	0.90	160,200	1,316,640
2	Ice Sluices and Walls at Powerhouse—					
	Concrete.....	c.y.	169,130	12.00	2,029,560	
	Concrete.....	c.y.	115,050	10.00	1,150,500	
	Foundation contingency.....				202,960	
	Excavation—earth.....	c.y.	214,020	0.65	139,110	
	rock footing.....	c.y.	23,920	2.40	57,410	
	Sluice gates, hoists, etc.....				133,600	3,713,140
3	Powerhouse Structures—					
	Concrete in substructures.....	c.y.	1,209,360	15.00	18,140,400	
	Superstructures.....				3,880,010	
	Gates and racks.....				3,584,090	
	Unwatering.....				1,943,500	
	Excavation—earth.....	c.y.	1,135,850	0.65	738,300	
	dry rock.....	c.y.	235,510	1.60	376,820	
					28,663,120	
	Credit for rock excavation.....				235,510	28,427,610
4	Railway Connection to Powerhouse.....					250,000
5	Engineering and Contingencies.....			25%		9,297,720
6	Total.....					46,476,000

(ii) Machinery and Equipment

1	Machinery and Equipment—					
	Generators and turbines.....				31,069,260	
	Switching.....				8,695,780	
	Cranes and service units.....				498,480	
2	Engineering and contingencies.....			25%		40,263,520
						10,064,480
3	Total.....					50,328,000

(C) WORKS COMMON TO NAVIGATION AND POWER

No.	Item	Unit	Quantity	Rate	Amount	Total
1	Channel excavation—					
	(a) Chimney Point—					
	Excavation—wet rock.....	c.y.	180,500	4.25	767,130	
	dredging.....	c.y.	255,190	0.90	229,670	\$996,800
	(b) Removal of Spencer Isd. pier—					
	Excavation.....	c.y.	123,950	1.50	185,930	185,930
	(c) Removal of Gut Dam—					
	Excavation.....	c.y.	44,640	1.50	66,960	66,960
	(d) Removal of centre wall Locks 27 and 25 and Canal Bank—					
	Excavation—Masonry and cribwork.	c.y.	14,630	1.60	23,410	
	Dredging.....	c.y.	181,000	0.90	162,900	186,310
	(e) North Galop Channel to below Baycraft Island—					
	Excavation—dry earth.....	c.y.	2,839,980	0.65	1,845,980	
	dry rock.....	c.y.	224,540	1.60	359,260	
	dredging.....	c.y.	2,197,000	0.90	1,977,300	
	wet rock.....	c.y.	232,690	4.25	988,930	5,171,470
	(f) South Galop Channel—from Butter-nut Isd. to south of Baycraft Isd.—					
	Excavation—dry earth.....	c.y.	464,610	0.65	302,000	
	dry rock.....	c.y.	2,620,530	1.60	4,192,850	
	dredging.....	c.y.	362,520	0.90	326,270	
	Unwatering—incl. banks.....				1,422,960	6,244,080
	(g) South of Baycraft Isd. to below Lotus Isd.—					
	Excavation—dry earth.....	c.y.	416,030	0.65	270,420	
	dry rock.....	c.y.	289,670	1.60	463,470	
	dredging.....	c.y.	2,648,780	0.90	2,383,910	3,117,800
	(h) South of Lalone Isd.—					
	Excavation—dry earth.....	c.y.	289,200	0.65	187,980	
	dry rock.....	c.y.	263,200	1.60	421,120	609,100
	(i) Sparrowhawk Point—					
	Excavation—dredging.....	c.y.	3,004,090	0.90	2,704,040	
	dry earth.....	c.y.	1,490,790	0.65	969,010	3,673,050
	(j) Galop Canal Bank, Presqu'isle and Toussaints Isd.—					
	Excavation—dredging.....	c.y.	2,557,600	0.90	2,301,840	
	dry earth.....	c.y.	324,770	0.65	211,100	2,512,940
	(k) Point Three Points—					
	Excavation—dredging.....	c.y.	3,442,590	0.90	3,098,330	
	dry earth.....	c.y.	1,052,130	0.65	683,880	3,782,210
	(l) Leishman's Point and Opposite Leishman's Point—					
	Excavation—dredging.....	c.y.	1,719,620	0.90	1,547,660	
	dry earth.....	c.y.	1,582,580	0.65	1,028,680	2,576,340
	(m) North and South side of Ogden Island—					
	Excavation—dredging.....	c.y.	1,400,780	0.90	1,260,700	
	dry earth.....	c.y.	3,814,700	0.65	2,479,560	
	dry rock.....	c.y.	65,490	1.60	104,780	
	Unwatering.....				194,930	4,039,970
	(n) Morrisburg Canal Bank and Canada Island—					
	Excavation—dredging.....	c.y.	1,364,930	0.90	1,228,440	
	dry earth.....	c.y.	201,300	0.65	130,850	
	masonry.....	c.y.	13,770	1.60	22,030	
	Rip-rap.....	c.y.	5,180	2.70	13,990	1,395,310
	Carried forward.....					34,558,270

(C) WORKS COMMON TO NAVIGATION AND POWER—*Continued*

No.	Item	Unit	Quantity	Rate	Amount	Total
	Brought forward.....					\$34,558,270
1	Channel excavation— <i>Concluded</i>					
	(o) North side of Cornwall Island—					
	Excavation—dry earth.....	c. y.	800,000	0.65	520,000	
	dredging.....	c. y.	634,560	0.80	507,650	1,027,650
	(p) South side of Cornwall Island—					
	Excavation—dry earth.....	c. y.	618,270	0.65	401,880	
	dredging.....	c. y.	3,150,370	0.80	2,520,300	2,922,180
	(q) Engineering and Contingencies.....			25%		9,627,900
	(r) Total.....					\$48,136,000
2	Ice Cribbs above Prescott and above Galop Isd.—					
	(a) Cribbs, booms and rock fill—					
	Cribwork.....				200,000	
	Booms.....				45,000	
	Rock fill.....				281,000	526,000
	(b) Engineering and Contingencies.....			25%		130,000
	(c) Total.....					656,000
3	Iroquois Point Dam—					
	(a) Dam—					
	Concrete.....	c. y.	91,340	16.00	1,461,440	
	Concrete.....	c. y.	22,450	12.00	269,400	
	Concrete.....	c. y.	6,470	10.00	64,700	
	Foundation contingency.....				173,080	
	Excavation—Earth.....	c. y.	37,890	19.00	719,910	
	Rock.....	c. y.	7,060	27.00	190,620	
	Earth.....	c. y.	69,920	0.90	62,930	
	Rock fill.....	c. y.	234,550	2.00	469,100	
	Gates, bridges, etc.....				682,200	
	Placing caissons.....				780,000	4,873,380
	(b) Engineering and Contingencies.....					2,436,620
	(c) Total.....					7,310,000
4	Dykes—					
	(a) North and South end of Iroquois Pt. Dam—					
	Earth fill.....	c. y.	83,720	0.90	75,350	
	Rock fill.....	c. y.	6,790	1.00	6,790	
	Stripping.....	c. y.	16,500	0.65	10,730	92,870
	(b) U.S. Shore-Wilson Hill to Louis- ville Landing—					
	Earth fill.....	c. y.	556,640	0.90	500,980	
	Rock fill.....	c. y.	50,120	1.00	50,120	
	Stripping.....	c. y.	106,400	0.65	69,160	620,260
	(c) West and East of Massena Canal—					
	Earth fill.....	c. y.	1,843,600	0.90	1,659,240	
	Rock fill.....	c. y.	185,990	1.00	185,990	
	Stripping.....	c. y.	231,920	0.65	150,750	1,995,980
	(d) Between Massena Canal and Navi- gation Canal—					
	Earth fill.....	c. y.	478,660	0.90	430,800	
	Rock fill.....	c. y.	29,510	1.00	29,510	
	Stripping.....	c. y.	72,170	0.65	46,910	507,220
	(e) East and West of Long Sault Dam—					
	Earth fill.....	c. y.	339,530	0.90	305,580	
	Rock fill.....	c. y.	48,840	1.00	48,840	
	Stripping.....	c. y.	32,360	0.65	21,030	375,450
	Carried forward.....					3,591,780

(C) WORKS COMMON TO NAVIGATION AND POWER—Continued

No.	Item	Unit	Quantity	Rate	Amount	Total
	Brought forward.....					\$3,591,780
4	Dykes—Concluded					
	(f) Canadian side—					
	Earth fill.....	c.y.	4,212,180	0.90	3,790,960	
	Rock fill.....	c.y.	583,550	1.00	583,550	
	Stripping.....	c.y.	392,820	0.65	255,330	4,629,840
	(g) On Barnhart Island—					
	Earth fill.....	c.y.	1,578,480	0.90	1,420,630	
	Rock fill.....	c.y.	126,600	1.00	126,600	
	Stripping.....	c.y.	201,590	0.65	131,030	1,678,260
	(h) Engineering and contingencies.....			25%		2,474,120
	(i) Total.....					12,374,000
5	Supply channel and weir at Massena—					
	(a) Supply channel and weir—					
	Concrete.....	c.y.	28,260	12.00	339,120	
	Concrete.....	c.y.	66,410	10.00	664,100	
	Foundation contingency.....				33,910	
	Excavation—rock footing.....	c.y.	5,400	2.40	12,960	
	rock trench.....	c.y.	650	4.10	2,660	
	earth.....	c.y.	988,540	0.65	642,550	
	dredging.....	c.y.	46,000	0.90	41,400	
	Concrete paving.....	c.y.	6,550	11.00	72,050	
	Gates, bridges, hoists, etc.....				82,100	1,890,850
	(b) Engineering and contingencies.....			25%		472,150
	(c) Total.....					2,363,000
6	Diversion cut through Long Sault Island—					
	(a) Diversion cut—					
	Excavation—dry earth.....	c.y.	2,172,420	0.65	1,412,070	
	dry rock.....	c.y.	29,110	1.60	46,580	
	dredging.....	c.y.	317,500	0.90	285,750	
	Concrete paving.....	c.y.	28,270	11.00	310,970	2,055,370
	(b) Engineering and Contingencies.....			25%		513,630
	(c) Total.....					2,569,000
7	Main Long Sault Dam—					
	(a) Dam—					
	Concrete.....	c.y.	709,070	12.00	8,508,840	
	Concrete.....	c.y.	81,290	10.00	812,900	
	Foundation contingency.....				850,880	
	Excavation—earth.....	c.y.	1,402,490	0.65	911,620	
	rock footings.....	c.y.	116,260	2.40	279,020	
	rock trench.....	c.y.	530	4.10	1,640	
	Gates, towers, hoists, etc.....				978,300	
	Unwatering.....				3,700,000	16,043,200
	(b) Engineering and Contingencies.....			25%		4,011,800
	(c) Total.....					20,055,000
8	Guard Gate, 14 ft. Lock and Weir at Maple Grove—					
	(a) Lock, entrance piers and weir—					
	Concrete.....	c.y.	98,340	10.00	983,400	
	Cribwork.....	c.y.	40,870	5.00	204,350	
	Excavation—earth.....	c.y.	859,600	0.65	558,740	
	earth trench.....	c.y.	5,790	4.00	23,160	
	Sheeting and bracing.....				15,950	
	Lock gates, sluice gates, hoists, etc.....				314,000	2,099,600
	(b) Engineering and Contingencies.....			25%		524,400
	(c) Total.....					2,624,000

(C) WORKS COMMON TO NAVIGATION AND POWER—*Concluded*

No.	Item	Unit	Quantity	Rate	Amount	Total
9	14 ft. Lock and Dykes at Iroquois—					
	(a) Lock—					
	Concrete.....	cu. yd.	19,140	10.00	191,400	
	Excavation—earth.....	cu. yd.	78,100	0.65	50,770	
	Earth fill.....	cu. yd.	162,040	0.90	145,840	
	Rock fill.....	cu. yd.	13,650	1.00	13,650	
	Stripping.....	cu. yd.	31,630	0.65	20,560	
	Lock gates, etc.....				60,000	
						\$482,220
	(b) Engineering and contingencies.....			25%		121,780
	(c) Total.....					604,000
10	Railroad relocation—					
	(a) Norwood and St. Lawrence Rly.....				207,500	
	(b) Canadian National Rly.....				2,750,000	
						2,957,500
	(c) Engineering and contingencies.....			25%		738,500
	(d) Total.....					3,696,000
11	Clearing Pool—					
	(a) U.S. side.....				359,000	
	(b) Can. side.....				55,000	
						414,000
	(c) Engineering and contingencies.....			25%		104,000
	(d) Total.....					518,000
12	Rehabilitation of Morrisburg.....					5,024,000
13	Rehabilitation of Iroquois.....					3,379,000
14	Acquisition of land, etc., U.S. side.....					4,657,000
15	Acquisition of lands, etc., Can. side.....					14,011,000
16	Highway relocation—					
	(a) U.S. shore.....				549,500	
	(b) Can. shore.....				1,700,000	
						2,249,500
	(c) Engineering and contingencies.....			25%		562,500
	(d) Total.....					2,812,000

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Apr 21/41	David, Dept. (MCA)
Apr 13/42	Mace
July 3/45	John Wilson grad.
1 Nov 46	John X. Cassin, 18 yrs. elect. Engin.
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